SPERRY MICROWAVE ELECTRONICS COMPANY
DIVISION OF SPERRY RAND CORPORATION

SPERRY

MICROLINE

COAXIAL FREQUENCY METER

MODEL - 126

SERIAL 993

X-80

E-178

MODELS
27B, 126, 207A and 536
3500 to 12,400 Mc

Coaxial frequency meters provide a rapid and satisfactory means for determining the frequency of microwave signals. This set of instruments is designed primarily for applications where ease of operation and compactness are more important than the highest degree of accuracy and resolution. The ranges of the Microline models in this group permit continuous frequency coverage from 3500 to 12,400 megacycles per second.

APPLICATIONS

These coaxial frequency meters are designed for general laboratory use and production testing. Throughout its frequency range, each instrument in the group has an absolute accuracy of one part in 1,000 and a minimum loaded Q of 400. These instruments may be used to monitor and measure unknown signal frequencies and also to tune microwave signal sources to a desired frequency.

Resonance indications of either the transmission or absorption (reactive) type may be obtained from any of these meters except Model 126, which is designed to produce an absorption indication only.

DESCRIPTION

These coaxial frequency meters are light, compact instruments. The main body of each consists of a length of rigid coaxial line of such a diameter that the outer conductor, with the inner conductor removed, acts as a circular waveguide-below-cutoff.

The center conductor projects into the main body through the shorting face of a quarter-wave trap terminating one end of the line. There is no actual contact between the shorting trap and center conductor at any point.

Tuning is accomplished by varying the insertion length of the center conductor within the main body, thus changing the resonant coaxial line length. Accurate control of the tuning position is obtained by

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designing the center conductor as an extension of the shaft of a precision micrometer rigidly mounted beyond the quarter-wave trap of the instrument. In models 27B, 207A and 536, the signal is introduced into the frequency meter through a type N connector and a short length of coaxial line. The line is terminated in a structure which couples it to the main body of the frequency meter. In model 126, the signal passes through a length of rectangular waveguide. A portion of the signal is coupled to the resonant coaxial line through a slot in the waveguide.

All models except model 126 are provided with an output coupling structure located opposite the input. This coupling device transmits a portion of the r-f energy from the main body of the instrument through a type 1N21B or 1N23B crystal rectifier to provide a transmission resonance indication. The center conductor of the removable BNC output connector is fitted with a crystal retainer and a disc type by-pass capacitor which prevents r-f leakage into the d-c line. Model 126 is designed for use only as an absorption (reactive) type frequency meter.

Electrical surfaces of all models are given a high-conductivity electroplated finish which also provides excellent protection against corrosion. Non-conducting surfaces are finished in black enamel.

These instruments require no adjustment beyond the normal tuning of the micrometer knob.

OPERATION

Coaxial frequency meters may be coupled directly to an r-f source to obtain a rough indication of frequency. For measurements of maximum rated accuracy, however, it will be necessary to decouple the instrument from the source. Near resonance, the impedance presented by the frequency meter at the junction to the line changes rapidly. In the absence of decoupling, the change in impedance will cause a reflection back toward the source which might result in a shift in oscillator frequency.

Such undesirable detuning effects of a changing load can be minimized if a 15- or 20-db matched attenuator pad is introduced between the signal source and thr frequency meter. Another method often used is to furnish the meter with only a small percentage of the r-f signal. This can be accomplished by means of a power divider such as a directional coupler.

Model 126, rigidly mounted to a short section of RG-52/U rectangular waveguide, operates as an absorption (reactive) frequency indicator only. The design of this model permits the instrument to be coupled directly into a waveguide transmission line at any convenient point with negligible effect on line impedance matching except when the

meter is tuned to resonance. In order to obtain an absorption resonance indication, means must be provided for monitoring the r-f power in the line. Resonance is indicated by a pronounced dip in the r-f power level.

All the frequency meters in this group require a reasonably well matched transmission line with a VSWR of less than 2.0 in order to prevent false resonance indications when absorption frequency readings are being obtained.

For transmission resonance indications with c-w signals, a d-c microammeter should be connected to the BNC output receptacle of the coaxial frequency meter. To obtain maximum sensitivity, use a meter with an input impedance of approximately 250 ohms. A peak current reading indicates resonance.

More sensitive indications may be obtained with a modulated source by an audio amplifier to increase the level of the detected signal. The indicating device at the output of the amplifier may be a meter or an oscilloscope.

CALIBRATION DATA

Each model is furnished with an individual calibration curve which applies to a certain instrument serial number only, and which should never be used as a standard curve with other coaxial frequency meters of the same model.

PRECAUTIONS

Since Model 27B operates at a quarter-wave line length, a frequency at any odd multiple of the frequency represented by the meter setting will produce resonance. Models 126, 207A and 536 are calibrated for a three-quarter-wave line length. Therefore energy at one-third or any odd multiple of the frequency represented by the micrometer setting will also produce resonance.

With modulated signals it is possible to obtain responses at the sideband frequencies. Care must be taken that these resonances are not confused with that of the main signal.

When square-wave modulation is used, two responses may be obtained which correspond to two modes of operation

of the Signal Source. The response at the undesired frequency can normally be eliminated by oscillator or modulator voltage adjustments to prevent the occurrence of the second mode.

MAINTENANCE

All critical adjustments required for the proper operation of these instruments have been performed at the factory, and therefore no adjustments and only minimum servicing will be required.

The mechanical construction of these coaxial frequency meters eliminates sliding contacts between the basic electrical elements when in operation, thus limiting any possible wear to the connectors and micrometer spindle threads only. Under no circumstances should the micrometer barrel and center conductor shaft be removed from any instrument since this would tend to alter the calibration.

When connecting any unit to other equipment, care should be taken to prevent damage to the type N signal input jack. An incorrectly assembled or defective type N mating plug may easily damage the slotted contact fingers of the jack inner conductor. This would tend to deform ormutilate these elements, produce undesirable reflections and increase the VSWR of the line. In properly assembled type N plugs the point of the inner conductor is normally flush with the slotted end of the outer conductor.

If the crystal rectifier requires inspection or replacement, it can be removed from the instrument after unscrewing the knurled sleeve on the output arm. The crystal should never be removed from its receptacle or handled in the presence of strong static or r-f fields because energy from these fields may be sufficient to burn out the crystal.

All connector contact surfaces should be kept clean to give good electrical contact. All contact surfaces should be maintained free of nicks and burrs to assure a good mechanical fit with mating parts.

Do not permit any foreign material to lodge within any part of these instruments since this impairs performance.

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Microline Model No.	Frequency Range (Mc)	Absolute Accuracy	Loaded Q	Input Impedance (Ohms)
27B	3500 to 6500	1/1000	400	50
207A	5300 to 8100	1/1000	400	50
126	8100 to 10200	1/1000	400	—
536	8100 to 12400	1/1000	400	50

PHYSICAL CHARACTERISTICS

Microline Model No.	Overall Size (Inches)[1]			Weight with Case	
	Length	Width	Height	lb	oz
27B	6-1/4	4-1/4	7/8	0	14
207A	7-1/8	4-1/4	7/8	1	0
126	5-3/4	5-1/4	1-7/8	0	15
536	6-1/2	4-3/8	1	0	13

1 Maximum length and/or width with tuning adjustment at full counterclockwise position. Length measured parallel to axis of transmission line (waveguide in Model 126) and width taken normal to the same line.

TRANSMISSION LINE AND CONNECTOR TYPES

Input: Models 27B and 207A are fitted with a type N jack similar to UG-23B/U. The input jack mates with UG-21B/U or other 50 ohm type N plugs connecting to 3/8 x 1/8 x 0.032 inch rigid or flexible coaxial line. The main body of Model 126 is mounted on a section of RG-52/U rectangular waveguide (1 x 1/2 x 0.050 inch). The input connector is AN type UG-39/U.

Output: Model 27B, 207A and 536 have a BNC output receptacle similar to UG-290/U.

TEMPERATURE AND HUMIDITY EFFECTS

The total frequency range is less than 0.1% over the temperature range from -40 to +55°C for all models. Humidity effects are negligible.

SERVICE AND REPAIR

Inquires regarding the servicing, repair or operation of any Microline instrument should be directed to Field Service Engineering Department at the address below. Do not return any unit before making this contact.

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Clearwater, Florida

SPERRY

MICROLINE
COAXIAL FREQUENCY METER
MODEL 126 SERIAL NO. 993
8100-10200 MC

CALIBRATION CURVE

FREQUENCY-MC

9200
9100
9000
8900
8800
8700
8600
8500
8400
8300
8200
8100

10200
10100
10000
9900
9800
9700
9600
9500
9400
9300
9200

.100 .150 .200 .250 .300 .350 .400 .450

.286

MICROMETER READING-INCHES

23-18008-C1